1. META equipment was tested on 8 flights in U-2C 383 in September and October 1969. No published test results were made available to OSA, however, the Project representatives termed the tests highly successful, according to Sam Mitchell.

2. After the tests the basic META equipment was returned to the U.S. Navy. Sam M. believes it would be readily available if needed.

3. Estimated cost for modifying an "R" hatch for META installation and flight testing system is $50,000.

4. Weight of equipment and framework is 300 lbs. Cube as configured for C model is approximately 6½. (Weight and cube do not include hatch)

5. The equipment produced "hard copy" imagery at a maximum distance from ground station of 255 NM, and "soft copy" TV imagery at 170 NM. Estimated ground resolution of "hard copy" was 5' - 7' in narrow angle (7^{o}), and 15'-20' in wide angle (28^{o}).

WORKING PAPER

APQ 128 (Package for [redacted])

Weight	:	213 lbs. (165 lbs. forward, 20 lbs. indicator, 28 lbs. sweep generator)
Cube	:	10.45 cubic feet. (8 boxes)
Largest Piece	:	20"x19"x24"
Power	:	1 KVA 400 H/AC, 200 watts 28 volt/DC
Range	:	160 miles (90^{o} sweep, K-Band)

FL 30 (Forward Looking IR System)

Weight	:	100 lbs.
Cube	:	2.42 cubic feet. (5 boxes)
Largest Piece	:	7"x19"x9"
Power	:	700 VA 400H/AC, 197 watts 28 volt/DC
Resolution	:	1/2 mile radius

Drift Sight Low Light Level TV

Weight	:	36 lbs.
Cube	:	.25 cubic feet (2 boxes)
Largest Piece	:	12"x6"x4"
Power	:	100 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	3 feet at Nadir

Data Link - AGM 53A

Weight	:	120 lbs (Pod mounted for F4C)
Power	:	640 watts
Transmission Data	:	6.25 MH-wide band - down link, 150 KH - up link

AAS-27, IR Line Scanner

Weight	:	150 lbs.
Cube	:	4.35 cubic feet (3 boxes)
Largest Piece	:	17"x17"x17"
Power Req.	:	75 VA 400 H/AC, 400 watts 28 volt/DC
Resolution	:	1/4 mile radius (15' @ 60,000 feet) 100^{o} field of view

D3, IR Scanner

Weight	:	185 lbs.
Cube	:	4.5 cubic feet (1 box)
Largest Piece	:	30"x15"x17"
Power Req.	:	1900 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	1/2 mil[redacted] rad[redacted] (30' @ 60,000 feet) 100° field of view

D4, IR Scanner

Weight	:	128 lbs.
Cube	:	2.65 cubic feet (1 box)
Largest Piece	:	11"x18"x23"
Power Req.	:	1800 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	1/2 mil[redacted] rad[redacted] (30' @ 60,000 feet) 100° field of view

D10A, IR Scanner

Weight	:	650 lbs.
Cube	:	41.5 cubic feet (1 box)
Largest Piece	:	63"45"x26"
Power Req.	:	2300 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	.1 mil[redacted] rad[redacted] (6' @ 60,000 feet) 100° field of view

D20A, IR Scanner

Weight	:	750 lbs.
Cube	:	74 cubic feet (1 box)
Largest Piece	:	72"x50"x36"
Power Req.	:	3600 VA 400 H/AC, 100 watts 28 volts/DC
Resolution	:	.05 mil[redacted] rad[redacted] (3' @ 60,000 feet)

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5. The equipment produced "hard copy" imagery at a maximum distance from ground station of 255 NM, and "soft copy" TV imagery at 170 NM. Estimated ground resolution of "hard copy" was 5' - 7' in narrow angle (7°), and 15'-20' in wide angle (28°).

W O R K I N G   P A P E R

APQ 128 (Package for TABID)

Weight	:	213 lbs. (165 lbs. forward, 20 lbs. indicator, 28 lbs. sweep generator)
Cube	:	10.45 cubic feet. (8 boxes)
Largest Piece	:	20"x19"x24"
Power	:	1 KVA 400 H/AC, 200 watts 28 volt/DC
Range	:	160 miles (90° sweep, K-Band)

FL 30 (Forward Looking IR System) Zerox Draft

Weight	:	100 lbs.
Cube	:	2.42 cubic feet. (5 boxes)
Largest Piece	:	7"x19"x9"
Power	:	700 VA 400H/AC, 197 watts 28 volt/DC
Resolution	:	3/4 mil rad 20°x15° FV; 1/4 mil 5°x6½° FV

Drift Sight Low Light Level TV

Weight	:	36 lbs.
Cube	:	.25 cubic feet (2 boxes)
Largest Piece	:	12"x6"x4"
Power	:	100 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	3 feet at Nadir

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Cube	:	4.35 cubic feet (3 boxes)
Largest Piece	:	17"x17"x17"
Power Req.	:	75 VA 400 H/AC, 400 watts 28 volt/DC
Resolution	:	1/4 mil rad (15' @ 60,000 feet) 100° field of view

SECRET

D3, IR Scanner

Weight	:	185 lbs.
Cube	:	4.5 cubic feet (1 box)
Largest Piece	:	30"x15"x17"
Power Req.	:	1900 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	1/2 mil rad (30' @ 60,000 feet) 100° field of view

D4, IR Scanner

Weight	:	128 lbs.
Cube	:	2.65 cubic feet (1 box)
Largest Piece	:	11"x18"x23"
Power Req.	:	1800 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	1/2 mil rad (30' @ 60,000 feet) 100° field of view

D10A, IR Scanner

Weight	:	650 lbs.
Cube	:	41.5 cubic feet (1 box)
Largest Piece	:	63"45"x26"
Power Req.	:	2300 VA 400 H/AC, 50 watts 28 volt/DC
Resolution	:	.1 mil rad (6' @ 60,000 feet) 100° field of view

D20A, IR Scanner

Weight	:	750 lbs.
Cube	:	74 cubic feet (1 box)
Largest Piece	:	72"x50"x36"
Power Req.	:	3600 VA 400 H/AC, 100 watts 28 volts/DC
Resolution	:	.05 mil rad (3' @ 60,000 feet)

structures of both prototypes. Thirty-five shells also were fired at the A-10A fuselage because the Fairchild aircraft has reserve fuel tanks located there in addition to those in the wings.

The use of foam-filled tanks in both wings and fuselage and external foam around the tanks is aimed at avoiding fires if the A-10A is struck by anti-aircraft fire. The foam surrounding will be incorporated in preproduction models of the Fairchild aircraft as a result of the survivability tests. When self-sealing tanks were hit in the tests, the hollow area around them speeded up the air flow to enhance burning. Adding foam eliminates this problem.

Bullet-resistant glass and 1,500 lb. of titanium armor plate surrounding the cockpit of each aircraft were tested against 250 anti-aircraft shells of various types.

All survivability testing was conducted as wind from a jet engine mounted on the test stand was blown over various components. The testing enabled officials to determine how components would react after being struck by anti-aircraft fire under various wind conditions.

In order to avoid loss of control in the A-10A if the aircraft is damaged by flak, two primary hydraulic control systems plus a manual cable system have been installed. Cables are separated by about 12 in. in a tunnel so they will not all be severed by a single shell explosion.

Mounting two General Electric TF34-GE-100 engines high on the aft fuselage, instead of under the wings as with Northrop's prototype, provided 10 external ordnance stations on which a mix of 16,000 lb. can be carried under the wings.

"It also results in less dust and foreign object damage when the aircraft is operating from small, unimproved forward landing fields," Gen. Stewart said.

An assortment of mixed ordnance was used and more than 700 bombs were dropped by each of the competitors in the test program. Pilots taking part in the tests were not allowed to fly the same heading twice during ordnance delivery tests.

Strafing competition was conducted along the same lines using the Vulcan gun system. "There was not much difference in accuracy to choose from," Gen. Stewart said.

The A-10A's clean wing with heavy ordnance stores located close to the centerline of the fuselage was graded high.

"It was a distinct plus," Gen. Stewart said.

A development program goal of 12 maintenance man-hours per flight hour was bettered by both prototypes. The Fairchild A-10A required 8.10 maintenance hours per flight hour and the Northrop A-9A needed 10.50.

The design-to-cost concept was employed in the prototype development phase. A flyaway cost of $1.4 million per aircraft was based on a production figure of 600 aircraft delivered at 20 airplanes per month.

Northrop constructed its two prototype models in the competition under a $28.9-million contract. Fairchild was awarded a $41.2-million contract to produce its two models for the fly-before-buy procurement approach.

"At first glance," Gen. Stewart said, "it looked like Fairchild was just going to be more expensive to do business with." He added that as the evaluation continued it became obvious that the A-10A would require a minimum of redesign if it were selected.

"The Fairchild people had their eyes further downstream in the company's approach to a prototype model," Gen. Stewart said. "We can do a great deal more with the Fairchild prototype than with the A-9A. The prototype-to-production transition will be much better with the A-10A."

He also said that the total program cost and program adequacy were about the same for both manufacturers, but the operational capability of the Fairchild aircraft was better.

The first of Fairchild's 10 preproduction models is scheduled to fly by the end of 1974. October, 1975, is the target date Gen. Stewart indicated for a decision on production of A-10As beyond the first production lot of about 40 aircraft.

The contract, which the Air Force will sign within the next two weeks, is a cost-plus-incentive fee type with an initial production option. A fixed-price incentive fee contract with a production option will be signed by the Air Force with General Electric to provide the engines for the first 10 aircraft.

Selection of Fairchild Industries means that the company will hire about 400 engineers immediately. Later, about 200 production workers will be hired with another 100 persons added in support jobs.

All those employed will be in the company's Farmingdale, N. Y., facility. This will bring the level of employment back to approximately 2,800, or about the same place it was last year before 600 persons were laid off after further supersonic transport development was halted. Fairchild Republic Div. was the largest subcontractor on the project.

General Electric will hire up to 400 more people at West Lynn, Mass., to begin work on the engines for the pre-production aircraft.

The decision will have no immediate impact on employment at Northrop's Hawthorne, Calif., facility, a company official said. Northrop now has about 6,300 workers at the California site.

Lockheed to Flight Test U-2 For Navy Surveillance Role

By Barry Miller

Los Angeles—Lockheed Aircraft will soon begin flight testing an EPX-designated version of the high-altitude U-2 aircraft configured to explore the application of the aircraft to the Navy's ocean surveillance mission.

The experimental Navy-funded effort will seek to determine the effectiveness of several sensors, including radar, electronic intelligence (Elint) receivers and forward-looking infrared, in monitoring maritime and naval ship movements from high altitudes. EPX stands for electronics patrol experimental.

The tests will be conducted off the Southern California coast with the EPX aircraft operated from Edwards AFB.

The potential naval surveillance mission (AW&ST May 8, 1972, p. 26) is one of several Air Force and Navy applications Lockheed currently is pursuing for the U-2. The company would like to reopen the production line for the aircraft, designed almost 20 years ago, if quantities required for any of these missions should exceed the handful of available U-2s not assigned to USAF or National Aeronautics and Space Administration.

A number of U-2s operated by the Nationalist Chinese air force could be recalled from Taiwan.

Lockheed also is working on a modified version of the U-2 intended for use in USAF's Senior Book program, a major continuing activity directed at collecting mainland Chinese communications intelligence (Comint) from high-altitude U-2s flying outside Chinese airspace. The Air Force currently employs U-2s based at Utaphao, Thailand, for these peripheral Comint gathering missions.

For the Senior Book program, the U-2 is being modified into a "minimally-manned" configuration. The pilot's role would be confined to handling the aircraft controls while the payload would be exercised remotely. Signals intercepted by the aircraft's receiving sensors would be transmitted in real time from a transponder in the U-2 over a data link feature in USAF's UPQ-3 microwave command guidance system. The aircraft would be tracked continuously by the command guidance system at line-of-sight ranges up to 400 mi. from a ground or an airborne station. The range could be extended by using an airborne station as a relay.

With the minimally-manned configu-

ration, USAF would be able to track the U-2 accurately throughout its flight profile and correlate the precise positional information with realtime surveillance data relayed from the high-altitude aircraft. USAF operated its Pave Eagle Beech QU-22 Bonanzas during their 18 months of surveillance from Nakhon Phanom in Thailand in much the same manner (AW&ST Jan. 22, p. 91).

USAF has been interested in expanding Senior Book collection activities, largely because of the unusual accident-free record of the U-2 in this specific mission, as contrasted with a somewhat similar drone signal intelligence collection program, called Combat Dawn, which has not had comparable reliability.

The upcoming flight tryouts of the EPX aircraft are expected to help settle doubts about the ability of sensors in a high-altitude aircraft to acquire useful data for sea surveillance. Navy wants to know whether certain sensors, like radar, can discriminate surface traffic against a background of sea clutter and how much and how far they can see effectively.

Lockheed regards the current EPX configuration as an interim one that could be replaced later by a less experimental version with better sensors. The company will test a number of sensors starting with the ALQ-110 Elint receiving system, built by United Technology Laboratories, Dallas, Tex., for use in a Lockheed EC-121 aircraft in Navy's Big Look Improvement program (AW&ST Feb. 21, 1972, p. 55).

The ALQ-110 system presumably would be able to intercept signals from radars on surface ships and permit at least the class of ship to be identified by analysis of radar frequency, pulse widths, pulse repetition rates, etc. On the EPX however, the system will operate with a reduced aperture antenna, diminishing its performance.

A highly-modified RCA X-band commercial weather radar will be in the interim EPX payload to obtain insight into the long-range surface detection capability of a higher-quality surveillance radar.

Limited Space

Limited antenna space and equipment availability are believed to have dictated choice of the weather radar over a surveillance radar for the initial tests. Navy is interested in higher resolution radars for this application, possibly Texas Instruments' APS-116 periscope detecting forward-looking radar from the Lockheed S-3A program or a side-looking radar.

To accommodate the antennas for the Elint and radar sensors, Lockheed has cut a 4-ft. hole in the belly of the U-2 where antennas for both sensors will be grouped together on a common pedestal. The antennas will be covered by a blister radome that will extend 3 ft. from the bottom of the aircraft's fuselage. Tryouts of other sensors, including forward-looking infrared, are planned subsequently.

IBM is assisting Lockheed with studies of time of arrival and distance measuring equipment techniques for target location.

The Navy still is undecided about how to conduct its sea surveillance missions, despite years of preliminary studies and modest development of airborne and satellite-based systems. Whether the role should be handled by satellites, aircraft or a combination of the two, and whether the aircraft need be carrier-based is unsettled.

A U-2 did successfully take off from an aircraft carrier near San Diego a few years ago, indicating that operation from a carrier is possible. There is strong feeling though that the aircraft's range and endurance are sufficient to enable it to satisfy Navy's on-station needs by operation from land bases.

Even in a large sea area like the Pacific, the U-2 might be able to orbit a carrier task force for 3-4 hr. before departing station for recovery at a land base. In many regions of the Mediterranean, it could provide 8-9 hr. of on-station surveillance. Since the Navy hasn't decided how far from its task forces sea surveillance has to be maintained, other manned aircraft may still be in the running. Both Lockheed and Martin Marietta performed mission analyses with the U-2 and other aircraft, including the Lockheed P-3C, for the surveillance role.

The P-3C is restricted to operation at lower altitudes, with consequent limitations on its instantaneous surveillance range, but it has advantages in payload capacity, extensive onboard processing and onboard crew judgments. The sensory data from the EPX will be data-linked back to the surface in real time for decision making.

In the course of its tradeoff studies of the U-2 for ocean surveillance, Lockheed has looked at options for carrying other avionics equipment, like laser designators/rangefinders, and even weapons such as the electro-optically-guided Condor air-to-surface missile.

While experiments with the EPX are taking shape, Navy is continuing its systems concept studies of an ocean surveillance satellite system (AW&ST Sept. 18, 1972, p. 12). The 749 satellite program is exploring a low-altitude satellite with high-resolution radar for tracking sea traffic and detecting low trajectory sea-launched missiles.

Quality of Imagery

As in the U-2 case, there is doubt that satellite-borne radar could yield radar imagery of enough quality to detect and identify sea traffic. The systems studies are conducted by McDonnell Douglas Astronautics assisted by RCA Corp., and TRW Systems assisted by Raytheon and Univac Div. of Sperry Rand.

The Navy also is interested in prospects of using the Compass Cope remotely piloted vehicles (RPV) now in prototype development if unmanned aircraft are practicable for operation with the fleet.

New Business

General Dynamics Electronics Div. has received an $18.17-million contract from the Federal Aviation Administration for advanced airport surveillance radars. The ASR-8 radars use dual-beam antennas that extend low-angle coverage, enhance raw radar return and reduce ground clutter.

Systems Development Corp. is being awarded $15.85 million by the U. S. Air Force Electronic Systems Div. for software and associated hardware for the Space Computational Center of the North American Air Defense Command (NORAD) Cheyenne Mountain complex.

Northrop Services, Inc., a subsidiary of Northrop Corp., will provide technical support to NASA's Manned Spacecraft Center under a $9.3-million contract for the first year with four one-year negotiable extensions. The contract has a potential value of more than $50 million over the five-year period.

Northrop Corp. Ventura Div. will produce 208 MQM-74C target aircraft drones (AW&ST Jan. 22, p. 91) under a $5.5-million contract from the U. S. Naval Air Systems Command.

Northwest Industries, Ltd., Edmonton, Alberta, Canada, has been awarded a subcontract from Boeing Co. for fabrication of 707 aircraft center wing structures. The potential subcontract value is $5 million.

Bell Helicopter Co. has been awarded a $6.56-million contract by the U. S. Army for 74 OH-58A light observation helicopters to replace a like number of OH-58As the Canadian armed forces received from an Army production contract during 1971-1972.

Singer Kearfott Div. has been awarded a contract totaling about $700,000 by the U. S. Navy Electronics Command for development of the Marine Remote Area Approach Landing System.

Calspan, Inc., will conduct a 12-month research and development program for the Advanced Ballistic Missile Defense Agency to improve endo-atmospheric designation and discrimination techniques and support ballistic missile defense interceptor technology in propulsion, guidance and control. The study contract is valued at $2.85 million.

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